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EXAMINER	
UHLIR, NIKOLAS J	

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1773	15

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Please find below and/or attached an Office communication concerning this application or proceeding.

(15)

Office Action Summary	Application No. 09/808,427	Applicant(s) OIKAWA ET AL.	
	Examiner Nikolas J. Uhlir	Art Unit 1773	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *04 August 2003*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-37 and 40-44* is/are pending in the application.

4a) Of the above claim(s) *1-23 and 32-36* is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *24-31 and 37-44* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. §§ 119 and 120

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

13)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application) since a specific reference was included in the first sentence of the specification or in an Application Data Sheet. 37 CFR 1.78.

a) ☐ The translation of the foreign language provisional application has been received.

14)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121 since a specific reference was included in the first sentence of the specification or in an Application Data Sheet. 37 CFR 1.78.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____.
4) ☐ Interview Summary (PTO-413) Paper No(s). _____.
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other:

DETAILED ACTION

1. This office action is in response to the amendment/request for continued examination (RCE) dated 8/04/03. Currently, claims 1-37 and 40-44 are pending, and claims 1-23 and 32-36 have been withdrawn from consideration.

Claim Rejections - 35 USC § 103

2. The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

3. Claims 24-27, 29-31, and 41-42 are rejected under 35 U.S.C. 103(a) as being unpatentable over Honda et al. (US5851643)

4. Claim 24 requires a perpendicular magnetic medium comprising a non-magnetic substrate, a first underlayer on the non-magnetic substrate, a second underlayer on the first underlayer, and a magnetic recording layer on the second underlayer; wherein the first underlayer contains titanium, the second underlayer contains Ru, and the magnetic recording layer contains Co.

5. Regarding these limitations, Honda teaches a magnetic recording medium that comprises a substrate, one or more underlayers on the substrate, and one or more magnetic layers on the underlayer(s) (figures 1a-e; column 8, lines 40-62; column 15, lines 57-67). In a particular embodiment, Honda teaches a medium comprising a substrate, a bcc underlayer on the substrate, an hcp underlayer on the bcc underlayer, and one or more magnetic layers on the hcp underlayer (column 8, lines 40-62). A media having this underlayer structure is taught to be a perpendicular recording medium (column 8, lines 46-47). Suitable materials for the BCC underlayer include at least one

element selected from Cr, Mo, W, V, Nb, and Ta (column 8, line 65-column 9, line 3), as well as Cr based bcc alloys containing one or more selected from V, Ti, Ru, or Co (column 5, lines 1-5).

6. Therefore it would have been obvious to one of ordinary skill in the art at the time the invention was made to utilize a CrTi bcc alloy as the bcc underlayer taught by Honda, as Honda teaches the equivalence of CrTi to the other materials listed as suitable for use as the bcc underlayer.

7. The examiner considers the CrTi bcc underlayer to be equivalent to applicant's claimed first underlayer containing Ti. With respect to applicants requirement of a 2nd underlayer containing Ru, Honda teaches that suitable materials for the hcp underlayer (formed over the bcc underlayer) include at least one element selected from the group consisting of Ti, Zr, Hf, and Ru (column 8, lines 63-65).

8. Therefore it would have been obvious to one of ordinary skill in the art at the time the invention is made to utilize Ru as the hcp underlayer taught by Honda, as Honda teaches the equivalence of Ru to the other materials listed as suitable for use as the hcp underlayer.

9. The examiner considers the Ru hcp underlayer taught by Honda to be equivalent to applicant's claimed 2nd underlayer containing Ru. Regarding the requirement of a Co containing magnetic layer. Honda teaches that suitable materials for the magnetic recording layer(s) include cobalt based alloys (column 9, lines 1-15). Thus, all of the limitations of claim 24 are met.

10. Claim 25 requires the first underlayer to be an oxide, nitride, or carbide of titanium, a TiCr alloy, or elemental titanium. This limitation is met as set forth above for claim 24.

11. Claim 26 further limits the group recited by claim 25 to nitrides of Ti, TiCr alloys, or Ti. This limitation is met as set forth above for claim 25.

12. Claim 27 requires the magnetic layer to additionally comprise Cr and Pt. Honda in a specific example teaches that the magnetic layer(s) are suitable made of a CoCrPt alloy (column 17, lines 45-50). Thus, this limitation is met.

13. Claim 29 requires the magnetic layer to be a multilayer structure prepared by alternately forming a ferromagnetic layer containing Co and a non-magnetic layer containing one selected from Ru, PT, and Pd. Honda teaches embodiments wherein multiple Co based magnetic layers are formed with a non-magnetic layer present between adjacent magnetic layers (see figures 1a-c; column 5, lines 45-55). Suitable materials for the non-magnetic layer include Cr, Ru, Ti, and V 9column 5, lines 45-55).

14. Therefore it would have been obvious to one of ordinary skill in the art at the time the invention was made to utilize Ru as the non-magnetic layer between the adjacent Co based magnetic layers taught by Honda, as Honda recognizes the equivalence of Ru to the other materials listed as suitable for use as a non-magnetic layer between two adjacent Co based magnetic layers.

15. Claim 30 requires a soft magnetic layer between the substrate and the 1st underlayer. Honda teaches a specific embodiment wherein a soft magnetic layer is

placed between the underlayer(s) and the substrate (column 23, lines 53-65). Thus, this limitation is met.

16. Claim 31 require the soft magnetic layer of claim 30 to be selected from one of the alloys listed. Honda teaches that suitable materials for the soft magnetic layer include Sendust (a known FeSiAl alloy) or amorphous soft magnetic materials 9column 23, lines 50-65).

17. Therefore it would have been obvious to one of ordinary skill in the art at the time the invention was made to utilize Sendust as the soft magnetic layer taught by Honda, as Honda teaches the equivalence of Sendust to the other materials listed as suitable for use as the soft magnetic layer.

18. Claim 41 requires the magnetic layer to have a single layer structure of a ferromagnetic layer containing Co. In a specific embodiment, Honda teaches that the magnetic layer can be a single layer (column 15, line 55-column 16, line 67; figure 1e)

19. Regarding claim 42, wherein the applicant requires the magnetic layer to have the same lattice constant and same concentration of added non-magnetic element. As set forth above, Honda teaches the use multiple magnetic recording layers having the same composition (and thus the same concentration of added non-magnetic elements) (column 15, lines 59-61 and figure 1b). Further, Honda teaches that though the lattice constant of the magnetic layers are preferably 1-5% different from one another (to induce stress between the layers), the same effect can be obtained with two magnetic layers having equal lattice constants through appropriate selection of the material for forming the intermediate layer (column 11, line 60-column 12, line 3).

20. Therefore it would have been obvious to one of ordinary skill in the art at the time the invention was made to utilize two magnetic layers having the same lattice constant in the invention of Honda, as Honda teaches that the effects that are achieved by utilizing two magnetic layers having differing lattice constants can be replicated by two magnetic layers having the same lattice constant so long as the material for the intermediate layer is carefully chosen. Thus, Honda teaches the equivalence of magnetic layers having the same lattice constant to those having differing lattice constants.

21. Claims 28, 37, and 43 are rejected under 35 U.S.C. 103(a) as being unpatentable over Honda as applied to claim 24 above, and further in view of Suzuki et al. (US6335103).

22. Honda et al. does not teach a magnetic recording medium that includes at least two magnetic layers, wherein the magnetic layers comprise Co, Pt and O, as required by claims 28 and 37.

23. It is noted that the structural limitations of claims 28 and 37 are met as set forth above by Honda, as Honda teaches a multiple magnetic layer structure separated by Ru intermediate layers, as discussed above. Further, the magnetic layers taught by Honda are suitably CoCrPt alloys, as discussed above. Further, as discussed above, Honda teaches that the multilayer magnetic layer can utilize magnetic layers having the same composition, as well as the same lattice constant.

24. Bearing this in mind, Suzuki et al. teaches that the noise of a magnetic layer can be reduced by incorporating 0.1-15% of oxygen into the magnetic layer (column 3, line 66-column 4, line 5).

25. Therefore it would have been obvious to one with ordinary skill in the art at the time the invention was made to incorporate oxygen as taught by Suzuki et al. into the magnetic layers taught by Futamoto et al. as modified by Honda et al.

26. One would have been motivated to make this modification due to the teaching in Suzuki et al. that media noise is reduced by incorporating oxygen into a magnetic layer, and because Futamoto et al. is concerned with obtaining a recording media that exhibits low noise. Thus, the limitations of claims 28 and 27 are met.

27. Regarding the requirement in claim 43 that the magnetic layers must contain the same amount of non-magnetic element. Given that Honda teaches that the magnetic layers can have the same composition, it would have been obvious to one of ordinary skill in the art at the time the invention was made to add the same amount of oxygen to each magnetic layer in the multiple identical magnetic layer structure taught by Honda.

28. Regarding the combination of Suzuki with Honda. The examiner acknowledges that Suzuki is drawn to a longitudinal medium whereas the embodiment of Honda relied upon by the examiner is a perpendicular medium. Although the ultimate end uses of Suzuki are different then that of Honda, one of ordinary skill in the art would have had a reasonable expectation of success in making the asserted combination, namely that it would have been obvious to incorporate oxygen into the magnetic layers of Honda. One of ordinary skill in the art would expect that incorporating oxygen into the magnetic

layers of Honda would result in a reduction in the noise of these magnetic layers, as the reduction in noise is attributed by Suzuki to be a result of the thickening of grain boundaries and the corresponding reduction in magnetic interaction between grains (see Suzuki, column 4, lines 1-5). This phenomenon is independent of the end use of the magnetic layer, and would be expected to occur in a magnetic alloy regardless of that alloys magnetic orientation.

29. Claims 24-27; 29; 40, 42, and 44 rejected under 35 U.S.C. 103(a) as being unpatentable over Futamoto et al. (US6447936) in view of Futamoto et al. (US6183893).

30. Regarding claim 24, Futamoto '936 teaches a magnetic recording medium comprising a substrate, a first underlayer 12 on the substrate, a second underlayer 23 on the first underlayer, a first perpendicular recording layer 13 on the second underlayer, and a second perpendicular recording layer on the first perpendicular recording layer (figure 2 and column 5, lines 48-63). In a specific embodiment, the first underlayer is a TiCr alloy containing 10 atomic % Cr (column 11, lines 25-40). The second underlayer is suitably a non-magnetic or weakly magnetic hcp alloy, such as $CoCr_{35}$ (column 5, lines 45-62; column 11, lines 25-35). The magnetic layer 13 is suitably a Co based alloy (column 4, lines 59-65).

31. Futamoto '936 fails to teach a second underlayer containing Ru, as required by claim 24.

32. However, Futamoto '893 teaches that suitable materials for forming a non-magnetic or weakly magnetic underlayer similar to that utilized in Futamoto '936 include

Co alloyed with 25-50% of a non-magnetic element, such as Cr, Re, W, Nb, etc. (column 9, lines 28-45). In a specific embodiment, a $CoRu_{45}$ alloy is utilized as the second underlayer (column 13, lines 15-30).

33. Therefore it would have been obvious to one of ordinary skill in the art at the time the invention was made to utilize the $CoRu_{45}$ alloy taught by Futamoto '893 as the non-magnetic or weakly magnetic hcp alloy 2nd underlayer taught by Futamoto '936, as Futamoto '893 teaches the equivalence of $CoRu_{45}$ to the other materials listed as suitable for a non-magnetic or weakly magnetic hcp Co based underlayer. More specifically Futamoto '893 teaches that $CoRu_{45}$ is equivalent to Co alloys containing 25-50 atomic % Cr. Thus, one of ordinary skill in the art would reasonably expect that the $CoRu_{45}$ alloy taught by Futamoto '893 would be equivalent to the $CoCr_{35}$ alloy utilized in Futamoto '936.

34. Regarding claims 25-26, these limitations are met as set forth above for claim 24.

35. Regarding claim 27, Futamoto '936 teaches that CoCrPt alloys are suitable for use as the first magnetic layer (column 11, table 1). Thus, the limitations of claim 27 are met.

36. Regarding claim 29, wherein the applicant requires the magnetic layer to have a multilayer structure wherein at least one ferromagnetic layer containing Co is formed with a non-magnetic layer containing one of Ru, Pt, or Pd. Futamoto '936 in certain embodiments teaches that the second magnetic layer is formed by alternately laminating Co with Pt or Co with Pd (column 11, table 1).

37. Regarding claim 40, this limitation is met as set forth above for claim 24.

38. Regarding claim 42, wherein the applicant requires the magnetic layer to comprise at least two ferromagnetic layers, wherein the layers have the same lattice constant and the same total concentration of an added non-magnetic element. This limitation is met as set forth above for claim 29. The second magnetic layer of Futamoto '936 comprises alternating layers of ferromagnetic Co and non-magnetic Pt. As the layers of Co and Pt are stacked, so long as there are at least 3 Co layers in the stack (i.e. Co/Pt/Co/Pt/Co) at least two of the layers will be formed on the same substrate (pt) and have the same content of added non-magnetic elements (0%). The second magnetic layers of Futamoto '936 is preferably formed to a thickness of 3-10nm, and in specific embodiments alternating 1.5nm Co/1.5nmPt films form this layer. Thus, with a 10nm film, a Co/Pt/Co/Pt/Co/Pt/Co structure is formed. As at least two of these films have the same composition, are formed on the same substrate, to the same thickness, and via the same method, the examiner takes the position that at least two of the magnetic layers in this multilayer stack will have the same lattice constant.

39. Regarding claim 44, this limitation is met as set forth above for claim 29.

Response to Arguments

40. Applicant's arguments filed 8/04/03 have been fully considered but they are not persuasive. The new grounds of rejection set forth above have rendered all of the applicant's arguments moot. However, for clarity, the examiner notes that the prior rejections were withdrawn in an effort to avoid a complex issue with respect to difference between the applicant's arguments, accepted scientific data, and the prior art. Specifically, the applicant argued on the record that the lattice constant difference

between a Ru based underlayer and a $CoPt_{20}$ film would exceed 5%. As a result, the applicant argued that the examiners prior rejections were untenable as the primary reference previously cited requires the difference in lattice constant between the magnetic layer and the underlayer to be 5% or less. To establish this argument, the applicant asserted that the shortest atom to atom distance of Pt is 2.77 angstroms, the lattice constant of Co is 2.71 angstroms, and thus the lattice constant of a $CoPt_{20}$ alloy is ~2.56 (see page 12 of the arguments). The examiner was highly confused by this argument for two reasons. First, the applicant argued on the record in a previous submission (paper #11) that the lattice constant of Co is 2.51 angstroms, not 2.71 angstroms. It appears that the applicant confused the lattice constant of Ru with that of Co. Second, the examiner was very confused as why the applicant chose to utilize the shortest interatomic distance of Pt as a factor which influences the crystal lattice structure of a CoPt alloy. The shortest interatomic distance (i.e. 2*radius) is not equivalent to lattice constant. This is evidenced by the fact that the lattice constant of pure Pt is reported in the 76th edition of the CRC Handbook of Chemistry and Physics (see page 4-139 attached) as 3.923 angstroms. The CRC value is also strongly supported in the patent literature. Thus, applicant's value of 2.77 angstroms appears to be erroneous. By weight averaging the shortest interatomic distance of Pt and the lattice constant of Co, applicant has combined two parameters that are not relevant to the same property.

41. However, as the above argument is directed to a combination that is no longer made, this argument is effectively moot.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Nikolas J. Uhlir whose telephone number is 703-305-0179. The examiner can normally be reached on Mon-Fri 7:30 am - 5 pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Paul Thibodeau can be reached on 703-308-2367. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9310.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703-305-0389.

NJU
Nju

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